INTRODUCTION

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Experience

- Kahala Hilton
- Mauna Kea Beach Hotel
- Mauna Lani Bay Hotel
- Phoenician Resort
- Orchid at Mauna Lani

Phoenician Resort Cogeneration Plant

- 1.65 Megawatt
- 535 Tons of Absorption Cooling
- Hot Water for Guestrooms
- Swimming Pool Heating

800 Kilowatt Cogeneration Project at the Orchid at Mauna Lani

The Orchid at Mauna Lani

- **Motivation** - mandated 5% energy reduction
- Aggregate $200,000 per annum in energy savings
- Solution cannot affect guest services
- Solution cannot affect guest comfort
- No capital dollars offered for implementation
- Chief engineers to be evaluated by results

Decision Making

- Cogeneration is a potential remedy
- Proposal solicitation from 3 vendors
- Also electric utility company (HELCO)
- Minimum annual savings of $200,000 to The Orchid at Mauna Lani
- Amortize system (equipment and installation) over life of contract

Response

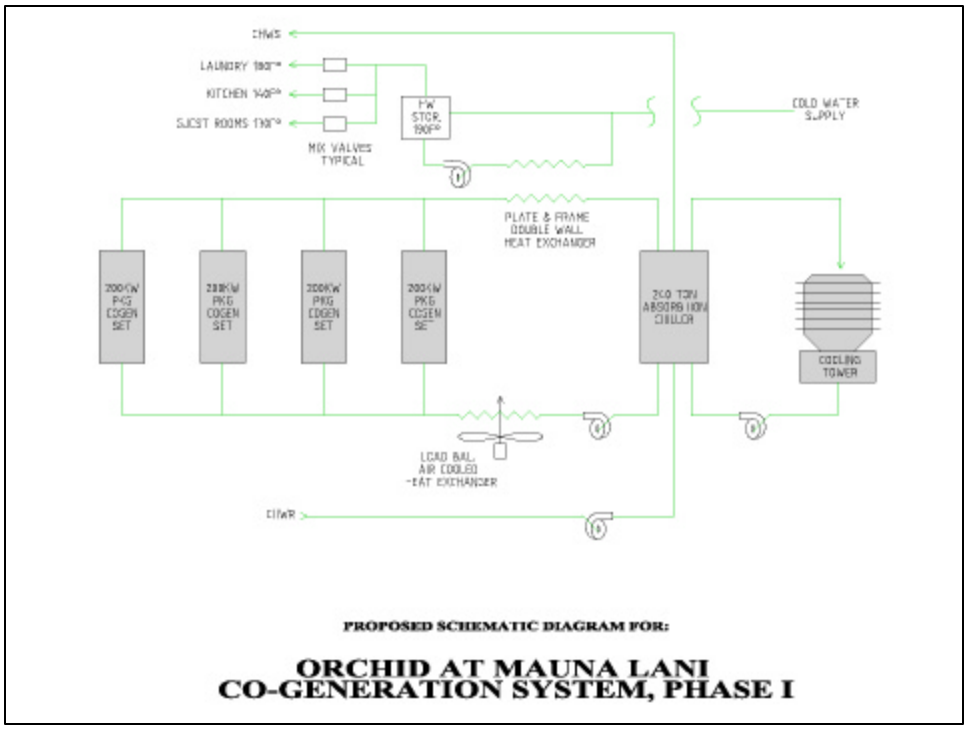
- Two viable responses received
- Hess Microgen most comprehensive
- HELCO proposal partial solution
  - customer retention discount
  - promise not to consider Cogeneration

Selection

- Hess Microgen was selected
- Design development began early 2000
- Plans submitted to HELCO
  - intention - interconnection safety review
  - instead - HELCO made several efforts to defeat the project
  - included offers of increased customer retention discounts

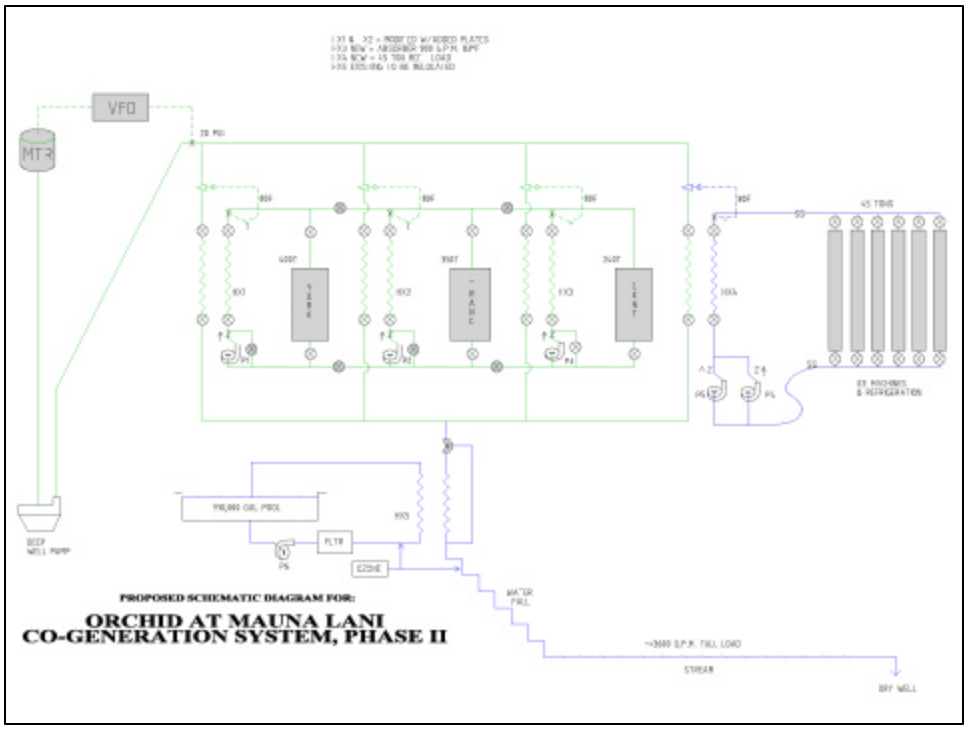
The Project

- Move forward in two phases
- Phase 1 - install the 800 kW Cogen plant
- Provide approximately 200 tons of absorption cooling
- Generate hot water for the laundry, kitchens, and guest rooms
- Fuel source to be propane to preclude any air quality concerns



Schematic of Phase I

- Thermal flow path for the Cogen plant
- First priority for heat recovery is hot water generation
- Absorption cooling is second priority
- Load balance heat exchanger provided to dissipate excess heat not used by hot water demands and the absorption chiller



Schematic of Phase II

- Schematically illustrates the addition of a deep well system to eliminate the cooling towers
- Brackish ground water will provide the heat exchange for all three chillers and the refrigeration systems
- Ground water will flow through the primaries of plate and frame heat exchangers with the secondary sides providing closed loop cooling circuits for their respective chillers

Continued Description of Phase II

- After flowing through the primaries, the warmed water will flow through the primary of titanium plate and frame heat exchanger to extract heat to warm a 330,000 gallon swimming pool to 86°F
- Discharge water will be ozonated and used to create a water feature
- Elimination of the cooling towers saves more than 15,000 gallons of potable water per day
- Eliminates the need for toxic chemicals to treat the recycled tower water and blow down discharge of the toxic water

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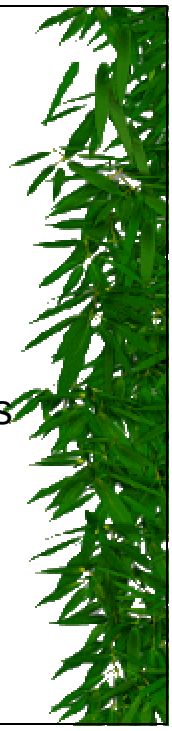
Operational Challenges

- Orchid Cogeneration plant has been on-line for approximately 6 months without mishap
- The plant is performing to expectations
  - with the exception of interconnection agreements
  - and the imposition of HELCO Rider A



Rider A Stand-by Charge

- As it stands, at 800 kW, $11.40 equates to $109,440 per annum penalty for being a Cogeneration facility
- HELCO's interconnection agreement requires the Orchid to install $61,000 in additional utility meters and tertiary (triple redundant) protective relaying
- Rider A is a punitive tariff applied to it's customers, The Orchid, et al.

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In Conclusion

- Cogeneration is not a new or emerging technology
- Cogeneration is as old (or older) than the public utility concept itself
- First hotel to employ Cogeneration was the Hotel Coronado in San Diego
- New and emerging technologies
  - such as fuel cell technology
  - infrastructure, politics, and mind sets are impediments
  - one or two decades will pass before these new technologies can make real inroads

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Further Conclusions

- Cogeneration provides a real way to stretch the fossil fuel efficiencies from 30% to greater than 80%
- Feed stock that makes propane is in over abundance in Hawaii and has to be exported
- It could be argued that using propane is renewable since it is the by-product of transportation fuel
- Rider A exempts renewables, like solar and wind, so why not Cogeneration?
  - It is obvious that it's sole intended target is Cogeneration and distributed generation